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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/605,108	09/09/2003	Dureseti Chidambarao	FIS920030183US1	2107
29625	7590	09/22/2005	EXAMINER	
MCGUIRE WOODS LLP 1750 TYSONS BLVD. SUITE 1800 MCLEAN, VA 22102-4215			PHAM, LONG	
			ART UNIT	PAPER NUMBER
			2814	

DATE MAILED: 09/22/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/605,108	Applicant(s) CHIDAMBARRAO ET AL.	
	Examiner Long Pham	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08/25/05.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4-18 and 21-29 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 16-18 and 21-29 is/are allowed.
- 6) ☒ Claim(s) 1 and 4-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>08/25/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Rejections and/or objections as previously applied

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1, 4, 5, 6, 12, 13, 14, and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) of this application in combination with Nayak (US 6,372,590).

With respect to claims 1, 4, 5, 14, and 15, AAPA teaches a method for manufacturing a semiconductor device, comprising steps of (see the Background of Invention of this application):

forming source and drain regions in an upper surface of a SiGe-based substrate, the source and drain regions containing an n-type impurity.

AAPA fails to teach forming source and drain extension regions in the upper surface of substrate and providing a vacancy-trapping element by implanting a noble gas or nitrogen into the source and drain extension regions.

Nayak teach forming n-type source and drain extension regions in an upper surface of an substrate and then providing a vacancy-trapping element by implanting a noble gas or nitrogen with implantation dose of 1×10^{14} to 5×10^{15} atoms/cm² and implantation energy of 1KeV to 100KeV into the source

and drain extension regions to reduce series resistance and hot carrier effects. See the abstract of Nayak.

It would have been obvious to one of ordinary skill in the art of making semiconductor devices to form source and drain extension regions in the upper surface of substrate and providing a vacancy-trapping element by implanting a noble gas or nitrogen with implantation dose of 1×10^{14} to 5×10^{15} atoms/cm² and implantation energy of 1KeV to 100KeV into the source and drain extension regions to obtain above advantages.

Further with respect to claim 1, since AAPA in combination with Nayak teach providing a vacancy-trapping element by implanting a noble gas or nitrogen with implantation dose of 1×10^{14} to 5×10^{15} atoms/cm² and implantation energy of 1KeV to 100KeV into the source and drain extension regions, the vacancy concentration in the source and drain extension regions would inherently be reduced and the diffusion of the n type impurity in the source and drain extension regions would inherently be decreased.

With respect to claim 6, AAPA further teaches that the SiGe-based substrate comprises a Si cap layer on a SiGe film on a silicon substrate.

With respect to claim 12, Nayak further teaches that source and drain regions overlap the source and drain extension regions. See figs. 1j and 1k.

With respect to claim 13, Since Nayak teaches providing a vacancy-trapping element by implanting a noble gas or nitrogen with implantation dose of 1×10^{14} to 5×10^{15} atoms/cm² and implantation energy of 1KeV to 100KeV into the source and drain extension regions and since Nayak teaches that source and drain regions overlap the source and drain extension regions, a vacancy-trapping element is provided in the source and drain region.

2. Claims 7, 8, 9, 10, and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over the applicant's admitted prior art (AAPA) of this application in combination with Nayak (US 6,372,590).

With respect to claims 7 and 8, Nayak fails to teach that the peak concentrations of the implanted nitrogen and n-type impurity of the source and drain extension regions are at the same depth from the upper surface of the substrate.

However, it would have been obvious to one of ordinary skill in the art of making semiconductor devices to determine the workable or optimal value or range for the depth for the peak concentrations of the implanted nitrogen and impurity through routine experimentation and optimization to obtain optimal or desired device performance because the relative depths of the nitrogen and impurity are result-effective variables and there is no evidence indicating that they are critical or produce any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

With respect to claim 9, annealing is well-known to one of ordinary skill in the art of making semiconductor devices.

With respect to claim 10, the annealing temperature and duration are result-effective variables and there is no evidence indicating that they are critical or produce any unexpected results and it has been held that it is not inventive to discover the optimum or workable ranges of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

With respect to claim 11, AAPA implicitly teaches forming a gate electrode on the upper surface of SiGe-based substrate with a gate oxide film therebetween. See the Background of Invention.

Response to Arguments

3. Applicant's arguments filed 08/25/05 have been fully considered but they are not persuasive. See below.

In response to the applicant's arguments in the paragraphs on pages 9, 10, and 11 of the applicant's response dated 08/25/05, it is submitted that the fact that the applicants have a different reason or advantage resulting from doing what the relied prior art suggested doing is not indicative or demonstrative of unobviousness. In *Re Kronig* 190 USPQ 425,428 (CCPA 1976); In *Re Lintner* 173 USPQ 560 (CCPA 1972). Further, it is submitted that a reference is considered not only for what it expressly states, but for what it would reasonably have suggested to one of ordinary skill in the art. In *re DeLisle*, 160 USPQ (CCPA 1969). Further, it is submitted if the nitrogen is introduced into the source/drain as taught by Nayak and claimed by the applicant, the vacancy concentration would be inherently reduced. Further, it is submitted that the motivation of introducing nitrogen into the source/drain is to reduce series resistance and hot carrier effect. See the rejection.

Allowable Subject Matter

4. Claims 16-18 and 21-29 are allowed.

Conclusion

5. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will

the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Long Pham whose telephone number is 571-272-1714. The examiner can normally be reached on M-F, 7:30AM-3:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on 571-272-1705. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Long Pham
Primary Examiner
Art Unit 2814

LP